Longley Meadows Fish Habitat Enhancement Project

Soils and Erosion Report

Prepared for:

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Date: April 12, 2019

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1 Introduction

The Longley Meadows Fish Habitat Enhancement Project (project) is located between river miles (RM) 143.6 and 142.0 of the Grande Ronde River (GRR) (Figure 1). The land within the project area is owned by the U.S. Forest Service (USFS) and the La Grande Rifle and Pistol Club (La Grande Gun Club). The active project area ranges from 3,050 feet of elevation at the downstream end to 3,080 feet at the upstream end and drains an approximately 475-square-mile watershed that reaches a maximum elevation of 7,923 feet. The mean annual precipitation averages 26.2 inches, most of which falls as snow during winter months. Most of the basin is forested (over 73 percent) and has very little development (less than 0.1 percent estimated impervious area) (U.S. Geological Survey [USGS] 2014). The reach was identified in the Upper Grande Ronde River Tributary Assessment (U.S. Bureau of Reclamation [Reclamation] 2014) as an unconfined geomorphic reach with high potential to improve physical and ecological processes to support salmonid recovery.

In the project reach, the UGR was historically likely an unconfined, forced alluvial channel with alternating pool-riffle and run bedforms. Beechie and Imaki (2014) empirically determined that intermediate-sized unconfined channels, similar to the UGR, that transport their sediment primarily as bedload and retain wood long enough to establish erosion-resistant points were transitional, and generally favored island-braided patterns in forested mountain systems (Cardno 2016a). Beechie and Imaki's (2014) data also show that island-braided channels are continually adjusting to intermittent perturbations, which sustains a high degree of successional states, resiliency, and habitat diversity (Cardno 2016a). Analysis of aerial imagery, light detection and ranging (LiDAR) and elevation data, and field observations of existing conditions and features including existing riparian vegetation and floodplain features was utilized to estimate the historical planform of the GRR within the project area. Based on the results of the analysis, field observations, and literature findings, it is believed that the GRR within the project area was a multi-thread channel with interconnected beaver wetland complexes.

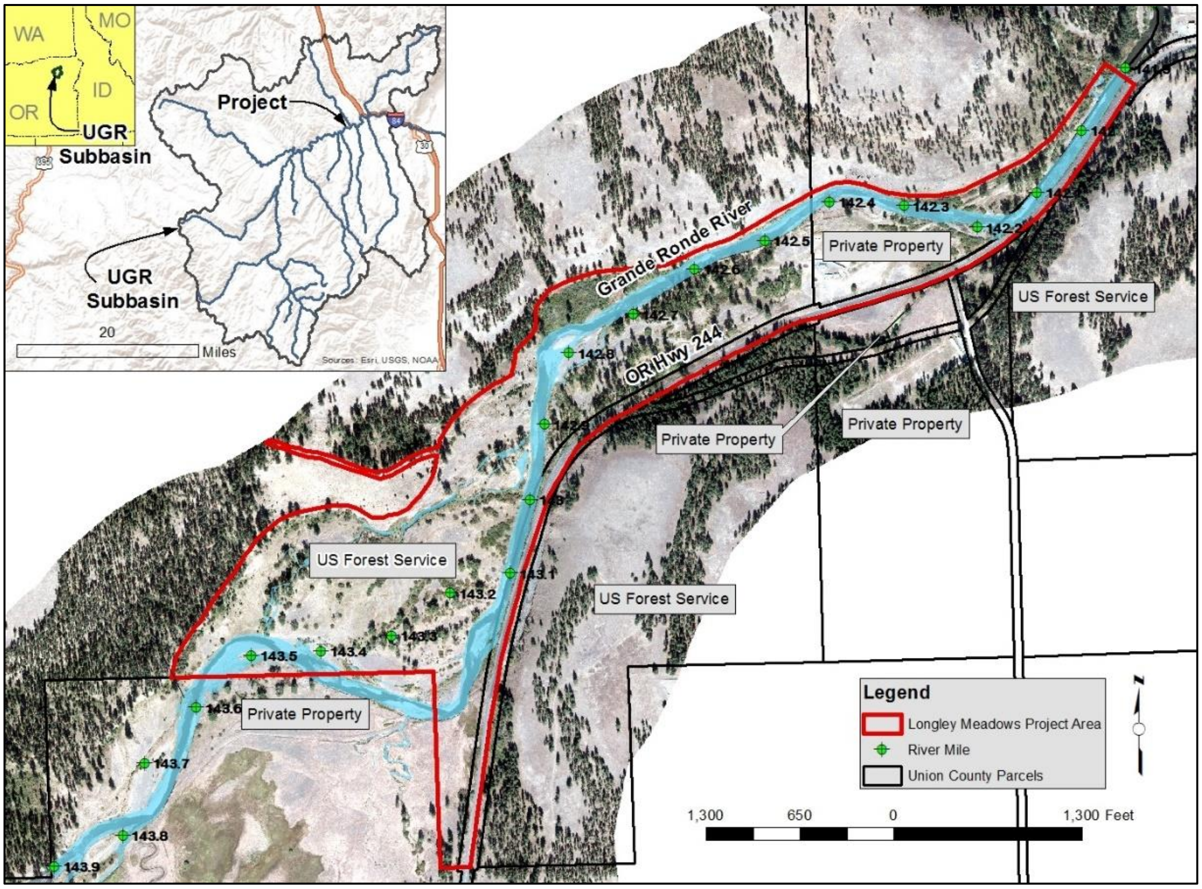

Figure 1. Active project area showing property ownership.

2 Affected Environment

2.1 Introduction

Soils are a complex mixture and their properties are based on source materials (geology), climate, vegetation, soil microbes, surficial processes, and time. The project area is located in the Blue Mountains physiographic province. The Blue Mountains originated in the Cenozoic era and feature extensive regional folding and faulting. The dominant geologic formation in the region is Grande Ronde Basalt, which is part of the Columbia River Basalt Group that covers large portions of the Pacific Northwest and originated in the Miocene. Locally, the Neogene sedimentary unit, which consists of tuffacious sedimentary rocks, originated in the Miocene/Pliocene era. The Powder River volcanic field has a small outcrop on the north side of the project area and also occurs to the south. It consists of Miocene-era andesite, dacite, and basalt that erupted from small volcanos located between La Grande and Baker City after the Columbia River Basalts were deposited. Most of the active project area is located in the GRR valley, which is covered with Quaternary surficial deposits consisting of alluvium (Oregon Department of Geology and Mineral Industries [DOGAMI] 2016). More detail on the regional geology, surficial geology, and geomorphic characteristics of the project area are presented in a Geomorphic Assessment appended to the Bird Track Springs Preliminary Basis of Design Report (Cardno 2016, Appendix B). Longley Meadows was originally proposed as part of the Bird Track Springs project, so both projects are analyzed in this report.

2.1.1 Soil Description

Soil descriptions and units described here cover 29.7 acres from the U.S. Department of Agriculture (USDA) *Soil Survey Report of Union County Area, Oregon* (2018) and 121.0 acres from the *U.S. Forest Service (USFS) Wallowa-Whitman National Forest, Oregon* (OR631) (2018). While the surveys listed were updated in 2018, the area of interest may have been surveyed at much earlier date. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries. Most notably the 121 acres mapped with OR631 does not include water, making the estimate of acreage of water below erroneous.

The upland soils are generally derived from the underlying basalt bedrock or tuff deposits and recent deposits of volcanic ash. They tend to have steeper slopes and be moderately deep, and moderately to well drained. They are used for wildlife habitat and timber production. The majority of the soils in the active project area in the GRR valley bottom are deep to moderately deep, well-drained soils that form in alluvial deposits. Their location in an active floodplain has subjected them to fluvial forces over time, which tend to disrupt the soil-forming processes that create deeper soil horizons that typically form through erosion, sorting, and deposition.

The soil unit that constitutes the majority of the active project area is Gulliford-Collegecreek-Bullroar complex (Unit 0001EW, Figure 2). The complex is found on bottom lands and low stream terraces and has slopes of less than 5 percent. It consists of approximately 40 percent Gulliford and similar soils, 35 percent Collegecreek and similar soils, and 25 percent Bullroar and similar soils. Gulliford parent material is alluvium from mixed sources including gravelly loamy sand, and gravelly sand. College Creek and Bullroar components include thick mantle of volcanic ash over alluvium and colluvium derived from basalt. Permeability is moderate, runoff is slow, and the hazard of water erosion is slight. Gulliford is poorly drained although the other two components of the complex are well drained. All are subject to flooding.

The other primary soil unit in the project area is Veazie-Voats complex (Unit 66, Figure 2). The complex is found on bottom lands and low stream terraces and has slopes of less than 3 percent. It consists of approximately 45 percent Veazie loam, 35 percent Voats fine sandy loam, and 20 percent other soils. Both Veazie loam and Voats fine sandy loam formed from basalt, andesite, or granite and are well drained. Permeability is moderate, runoff is slow, and the hazard of water erosion is slight. Both soil types are subject to flooding.

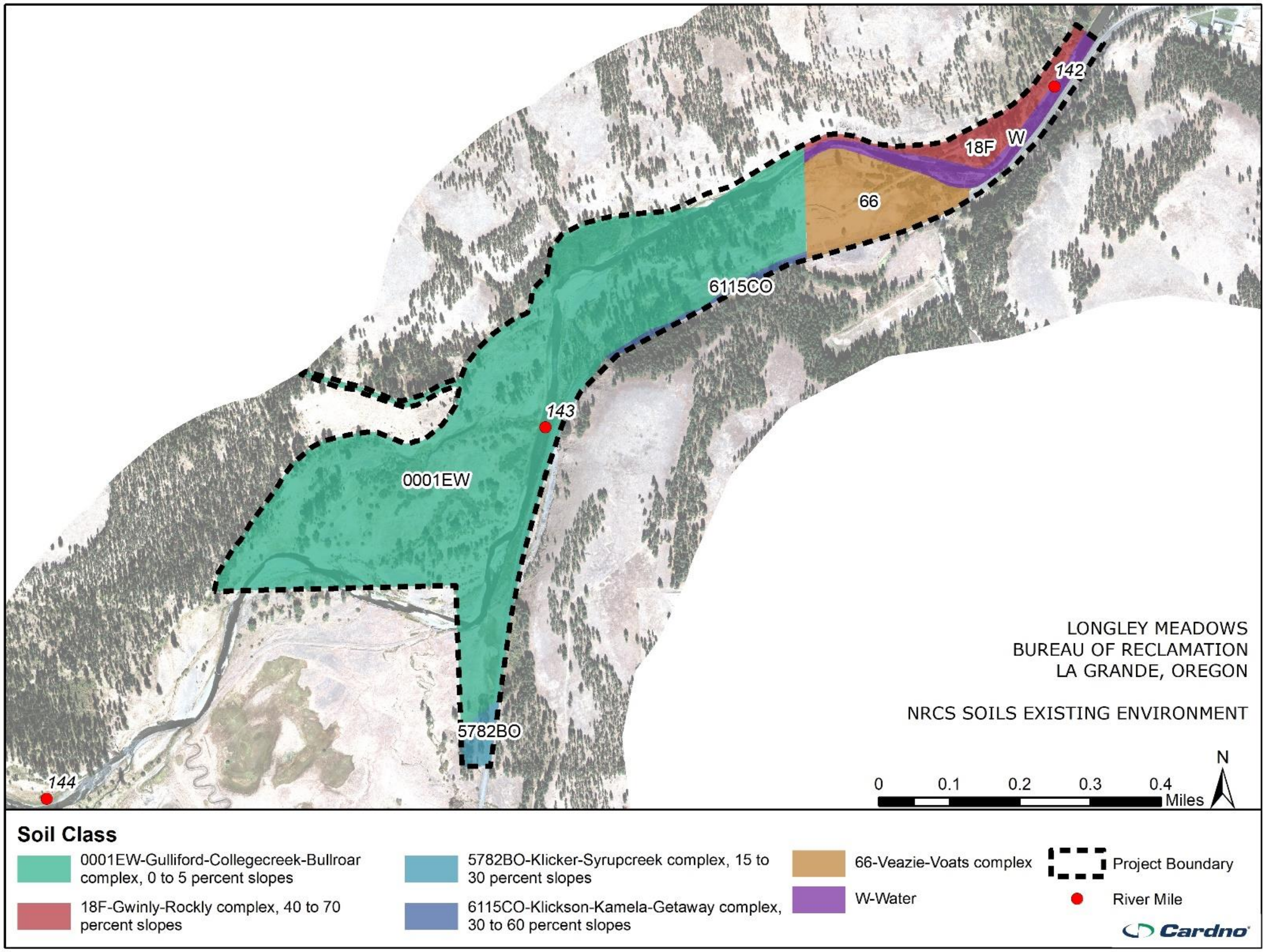

Figure 2. Active project area showing soil types.

Table 1 lists the soil types, acreages, and features of the soils within the active project area (soils covering less than 1 percent of the active project area were not included in the table). None of the soils are hydric. The hydrologic soil group rating is based on the soil's runoff potential. Group A generally has the smallest runoff potential, and Group D has the greatest.

Table 1: Soil Types and Characteristics of Soils within the Active Project Area

Code	Name / Surface Texture	Slope (percent)	Drainage Class	Hydro-logic Soil Group	Erosion Potential	Acres	Percent
0001EW	Gulliford-Collegecreek-Bullroar complex	0-5	Well	B	Slight	116.2	77.1
66	Veazie-Voats complex - loam	0–3	Well	B	Slight	14.6	9.7
18F	Gwinly-Rocky complex	40-70	Well	D	Very Severe	6.7	4.4
5782BO	Kickler-Syrupcreek complex	15–30	Well	C	Moderate	2.1	1.4
6115CO	Klickson-Kamela-Getaway complex	30-60	Well	C	Severe	1.7	1.1
W	Water					6.5	4.3

In addition to the general soil mapping units and descriptions from the soil survey described above, the active project area has additional features that were identified from field studies including wetlands (described in the Hydrology, Floodplains, and Wetlands Report), test pits dug for cultural resource investigations, and a geomorphic assessment that identified areas of soil disturbance. The geomorphic assessment identified elements that have impacted floodplain functions including abandoned railroad grades, road grades, and levees where soils have been disturbed by past activities. Recreational trails from the Bird Track Springs Campground also traverse the site. Trail use appears to be primarily by hikers, although occasional off-highway vehicle (OHV) use may occur on-site. Detrimental soil conditions on the USFS portion of the active project area were not determined quantitatively, but given the limited soil-impacting activities and minimal soil impacts observed on-site, detrimental soil conditions are estimated at well below 20 percent.

Test pits dug in the active project area for cultural resource investigations found that the typical near-surface alluvial stratigraphy includes a surface layer of fine sediment (<2 millimeters [mm] and smaller) interpreted as overbank flood deposits, underlain by a layer of river-lain sandy gravel. The thickness of overbank deposits varies from 0 to over 3 feet and averages 1.25 feet across the site, as documented by the cultural test pits. These overbank deposits are characterized texturally as silty sand to sandy silt. The underlying sandy gravel layer is projected to have grain sizes similar to those measured in eroding banks.

3 Impacts Analysis

3.1 Introduction

The following describes the potential impacts of implementing the proposed action on soils in the active project area and the upland log source areas with a focus on impacts to soil including the potential for erosion and loss of soil productivity.

3.2 Methods and Assumptions

Soil erosion is a natural process that can be accelerated by land management activities; the rate of erosion depends on soil texture, rock content, vegetative cover, and slope. For example, ash soils have higher erosion hazard ratings than other soils due to their low bulk density and high detachability. This hazard can be minimized by operating on slopes less than 30 percent with good vegetative cover. Vegetation binds soil particles together with roots, and vegetative cover—including biological crust and duff/surface material—protects the soil surface from raindrop impact and dissipates the energy of overland flow (USFS 2015).

Soil productivity of a site is defined as the ability of a geographic area to produce vegetative biomass, as determined by abiotic conditions (e.g., soil type and depth, rainfall, and temperature) in that area. Specifically, as related to soils in this analysis, productivity is related to the capacity or suitability of a soil for establishment and growth of appropriate plant species, primarily through physical impediment to root growth, water availability, and nutrient availability.

Productivity of forested and non-forested plant communities is closely related to ash and loess content in soils. Characteristics of ash soils include: 1) high water holding capacity, 2) high water infiltration rates, 3) low bulk density, 4) low strength, 5) high compactibility, 6) high detachability, and 7) disproportionately high amounts of nutrients in upper surface layers. Ash soils can contain volcanic glass fragments, and in general are susceptible to disturbance from forest management practices. Under undisturbed conditions, these soils support good vegetation cover, which protects the ash from erosion (USDA 2007).

Key indicators for the analysis include:

- Acres of soil disturbance
- Acres of potential soil compaction and displacement
- Acres of new and temporary roads

Project impacts and potential changes in key resource indicators have been estimated for two time frames: short and long term. Short-term impacts generally occur in the period during and immediately after construction, but could last up to 2 years from the start of the project. Long-term impacts occur in the period of time between the end of short-term impacts and approximately 5 to 25 years in the future. Conservation measures and best management practices (BMPs) that would be followed during design and construction of the project have been included in this analysis and are described in Description of Alternatives section of the EA.

Management activities can result in direct, indirect, and cumulative impacts to soil productivity and stability (USFS 1998). Impacts may be beneficial or adverse and could include alteration of physical, chemical, and/or biological characteristics or properties of soils.

Types of soil impacts expected to occur under implementation of the proposed action are summarized here and described in more detail in Section 3.3. Impacts to soils can be short term in the case of erosion potential; the length of time for which risk of soil erosion is a concern depends on soil type and vegetative cover. The most adverse impacts of management activities on soils are described as detrimental compaction, detrimental puddling, detrimental displacement, detrimental burning, detrimental erosion, and detrimental mass wasting; other concerns include adverse changes in vegetation and organic matter on the soil surface, and adverse changes in the water table (USFS 1998). Soil compaction, puddling, displacement, severe burning, and impacts to ground cover (vegetation and organic matter) are direct impacts; soil erosion, mass wasting, and changes in the water table are indirect effects. Erosion control measures normally occur immediately following treatments, and/or revegetation occurs in the first year or two. Other impacts to soils such as compaction, rutting, and displacement tend to be longer term and can be cumulative in nature if soils have not fully recovered prior to a new activity occurring in the same location. Cumulative effects are the sum of incremental changes in past, present, and reasonably foreseeable future direct/indirect impacts on the soil resource that overlap both in time and space.

3.3 Direct and Indirect Impacts to Soils

3.3.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, the restoration project would not occur in the floodplain and trees would not be harvested in the log source area. Activity on National Forest lands would continue to be governed by current land management and transportation plans and could include agency actions such as road maintenance, noxious weed treatments, and public activities such as fuel-wood removal, mining, and recreation. Activities on private lands would continue and could include actions such as grazing, timber removal, vegetation management, and recreation. Other Reclamation restoration projects would likely be constructed along the GRR.

All current detrimental soil conditions would continue to exist, with some conditions improving, others remaining static, and still others deteriorating over time. Some new detrimental soil conditions are likely to occur from the above-listed ongoing activities.

3.3.2 Alternative 2 – Proposed Action

A detailed description of the proposed action is provided in the Proposed Action and Alternatives section. Proposed activities in the active project area that could impact soils include:

- Temporary access road construction and use
- Staging area construction and use
- Grubbing, grading, cutting, and filling
- New channel construction and back-filling
- Placement of logs, boulders, rock, and fill
- Potential leaks and spills from construction equipment

With the exception of logs, some large boulders, additional rock, native seeds, and seedlings, all materials used for the project would be from within the project site and repurposed in construction of new channel features and floodplain elements. Existing boulder-rock weirs would be removed and boulders repurposed as habitat features or structural ballast. Abandoned reaches of the existing channel would be filled using excavated material from constructed channel segments. Figure 3 illustrates the proposed new channel configuration and the areas of the existing channel that would be filled. Existing riparian vegetation, topsoil, shrubs, and trees that require removal would be salvaged and reused in the floodplain. At this time, it is not expected that any native materials would be removed from the project site. Non-native materials (trash, noxious weeds, etc.) would be removed if found during construction.

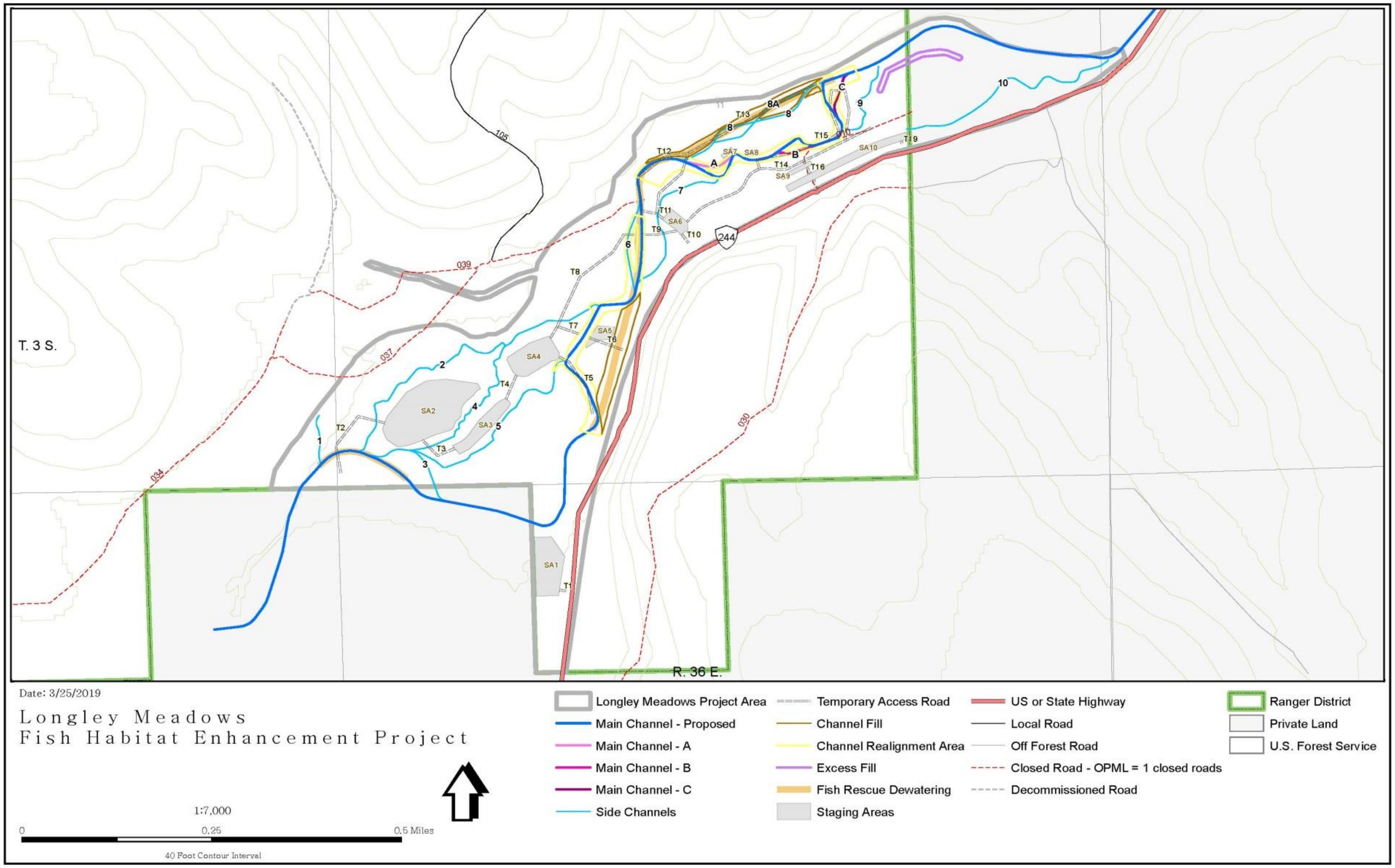

Figure 3. Draft concept showing project elements and potential soil effects.

Potential impacts to soils include removal of the organic layer and vegetation exposing mineral soils over approximately 40 (28% of the project area) acres to splash, sheet, rill, and gully erosion; compaction and displacement of surface and subsurface soil layers; mixing of soil layers during recontouring and restoration; and contamination with pollutants from leaks and spills. All of these potential impacts could reduce soil productivity and contribute to sedimentation in the river. Table 2 lists the proposed activities and the area of each soil type affected. Figure 4 shows mapped soil types with the proposed project elements.

Table 2. Acres of Soil Disturbance by Activity and Soil Type (acres)

Soil Code	New Channel	Large Woody Material Staging	New Access Road	Staging and Storage Area	Total
001EW	28.671	0.9727	0.819	8.7543	**39.217**
66	0.812	0	0	0	**0.812**
18F	0	0	0	0	0
5782BO	0	0	0	0	0
6115CO	0	0	0	0	0
W	0.048	0	0	0	**0.048**
Total	29.531	0.9727	0.819	8.7543	**40.077**

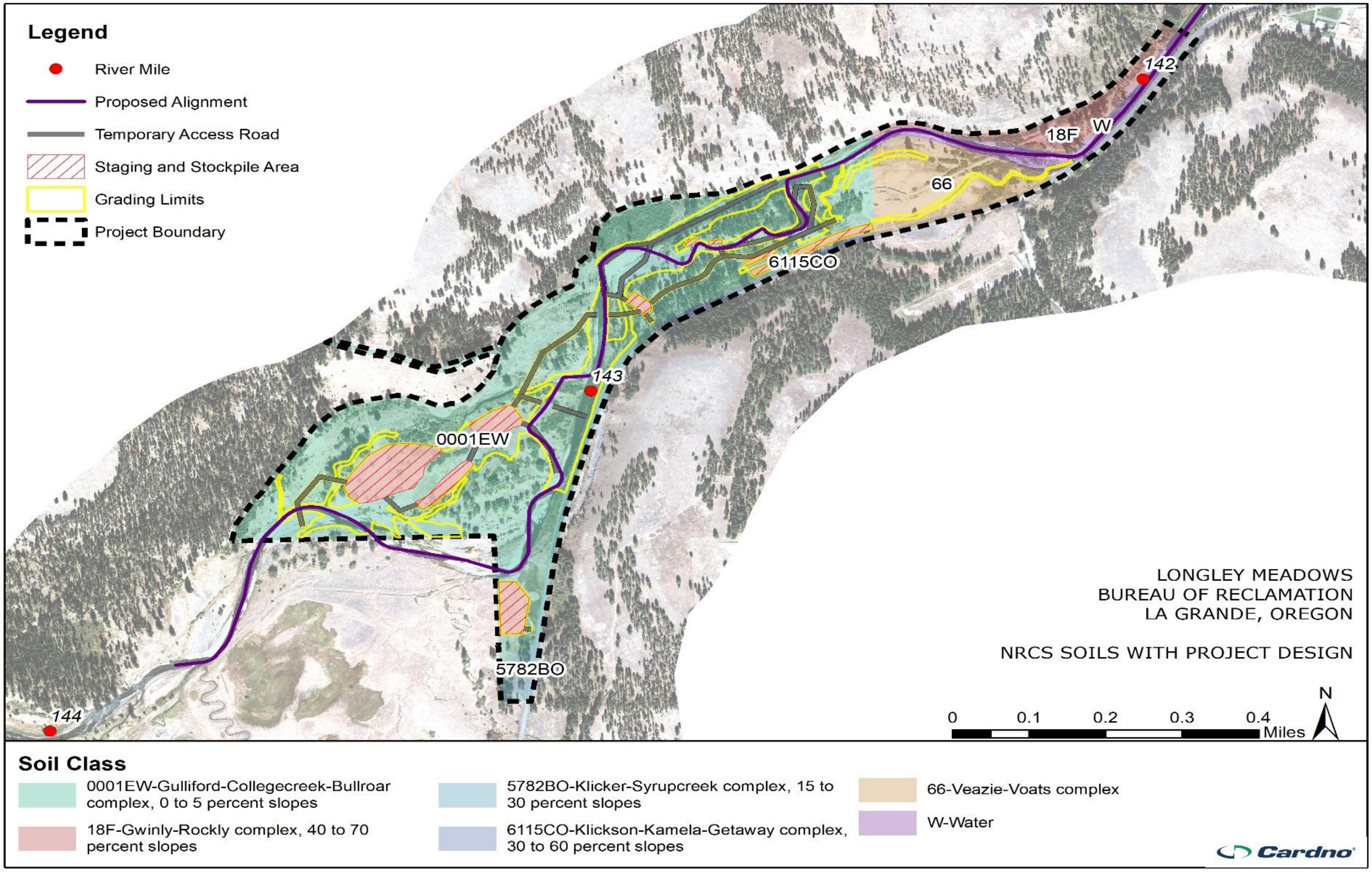

Figure 4. Active project area showing proposed project elements and mapped soil units based on the Soil Survey Report of Union County Area (2018).

A suite of Best Management Practices (BMPs) and Project Design Criteria (PDC) will be integrated into the design of alternatives and the analysis of effects to ensure that relevant natural resources, tribal treaty resources, and social values are managed and protected in a manner consistent with policy, law, and regulation. BMPs and PDCs will also serve to ensure that implementation of the actions described in the Decision Notice are properly executed. The applicable PDC's for disturbance for this project are as follows:

Soil Productivity:

Prior to September 30th or seasons ending precipitation event, whichever comes first, ensure necessary water control structures are installed and maintained on skid trails over 10% slope after all ground-disturbing activities. Ensure erosion control structures are stabilized and working effectively, and ensure that effective ground cover is left.
In areas of general disturbance in ash soils, the top layer (A Horizon) should be pulled back over any disturbed surface to prevent permanent loss of productivity. (Pull berms back over disturbed surfaces). After completion of land management activities, the minimum effective ground cover (EGC) within each activity area shall be in place to prevent erosion from exceeding background erosion rates for each of the four established erosion hazard classes: low, medium, high or very high (table below). Effective ground cover is defined as the basal area of perennial vegetation, plus litter and coarse fragments (greater than 2mm sizes), including tree crowns and shrubs that are in direct contact with the ground.

Soil Erosion:

Management activities that leave organic matter on the soil surface reduce soil erosion potential. To reduce surface erosion potential, disturbed areas within these units would be required to have a minimum of 60 to 90 percent effective ground cover following cessation of any soil-disturbing activities (R6 Soil Quality Standard) PDC's for erosion are the same as those indicated above for soil productivity. Any increase in overland flow from existing areas of compacted soil is likely to be buffered by existing forest floor and/or new accumulations of woody debris.

Soil Stability:

Soil surveys indicate areas of very severe erosion potential (18F, Table 1), however no project elements or construction related activities are located in this soil type. No PDC's are applicable as there will be no effects related to soil stability.

Cumulative Effects on Soils

Potential cumulative effects are analyzed by considering the proposed activities in the context of past, present and reasonably foreseeable actions. Reasonably foreseeable future actions are defined as activities that will occur within the next 5 years. These are the areas where cumulative effects have occurred or may occur. In addition, some activities have an influence that may extend downstream in the subwatershed within the project area boundary. This broad area is referred to as the "cumulative effects analysis area," and in general all alternatives are considered in the context of relevant past, present, and reasonably foreseeable activities in this area. Activities that occurred in the past have been incorporated into the existing condition assessment of the project area.

3.4 Alternative 1 – No Action Alternative

The only reasonably foreseeable future actions that would overlap in time and space within this project area that have the potential to result in short-term increase in soil impacts would be OHV use, livestock grazing, and continued timber management on private lands.

However, the Bird Track Springs Restoration Project is located immediately upstream of the Longley Meadows Fish Enhancement Project and includes similar restoration elements.

Erosion is expected to be localized to areas with OHV use, livestock grazing, and continued timber management on private lands. Soils in areas within the project boundary that are at wildfire risk could be influenced by a combination of wildfire and the erosion processes accompanied with high winds. Winds can transport soil aloft and to a new location. This would prove to be a loss to soil productivity within a proposed unit, if this occurs it is unknown if some portion of this material would end up as sediment. The potential duration of expected erosion risk would be for at least 3 years immediately following wildfire (Elliott et al. 2001; Robichaud 2000). The volumes of erosion under this risk are also influence by the intensity and duration of precipitation events that occur during elevated erosion risk. Detrimental soil conditions that are assumed to be created by equipment traffic may be long-lived (>40 years).

3.5 Alternative 2 – Proposed Action

A summary of the present and reasonably foreseeable future management activities in the cumulative impacts analysis area is presented in Table 3 and has been used to assess the cumulative impacts of implementing this project on soil resources.

Table 3: Cumulative Effects Determination Table.

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Effects
		Time	Space		
Noxious Weed Management: Wallowa-Whitman Invasive Species Treatment Record of Decision	Reduction of invasive species competition	Yes	Yes	No	No impacts to soil resources expected.
Vegetation Management: BTS Fuel Reduction Project BTS Campground Project Spring Crk Small Sale		No	No	No	
Special Uses: • OTEC Powerline • Fly Fishing O/G Permit • LG Rifle & Pistol Club		Yes	Yes	No	Powerline is suspended over the river; no impacts expected from this powerline or fly fishing to soils.

Table 3: Cumulative Effects Determination Table.

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Effects
		Time	Space		
Recreation: Bird Track Springs Interpretive Trail		Yes	Yes	No	This trail would be moved as part of this project; therefore, this would be a direct/indirect effect, not cumulative.
Recreation: Dispersed camping		Yes	Yes	No	No impacts to soil resources expected.
Recreation: Snowmobile trails		No	No	No	
Recreation: Firewood cutting		Yes	Yes	No	No impacts to soil resources expected within the cumulative effects analysis area.
Recreation: OHV use		Yes	Yes	No	Unauthorized user-built OHV trails and OHV use is spread across most of the landscape within the Spring Creek area, contributing to sediment production and soil compaction. Soils could be impacted in the short term, but the long-term benefits of the project and implementation of travel management within the project area would yield a net improvement in soil conditions.
Recreation: Bird Track Springs Campground		Yes	Yes	No	The campground is separated from the GRR by Highway 244. Recreation activities within the campground have no effect on the active project area.
Roads & Trails: Travel Management Plan		Yes	Yes	No	See OHV use above.
Road maintenance on Highway 244		Yes	Yes	No	No impacts to soil resources expected within the cumulative effects analysis area.
Roads: Danger Tree Removal		Yes	Yes	No	No impacts to soil resources expected within the cumulative effects analysis area.
Grazing Allotment: Spring Creek Sheep Allotment Special #2 Allotment		No	No	No	
Fisheries Enhancement: Fish logs from Bird Track Springs Campground	Short-term soils impacts from restoration activities Short-term	Yes	Yes	Bird Track Springs Campground – No	Some large tree removal is planned within the campground area for another fish enhancement project. Trees would be cut down, loaded with a log forwarder, and hauled off-

Table 3: Cumulative Effects Determination Table.

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Effects
		Time	Space		
Bird Track Springs Fish Habitat Enhancement	water quality impacts from restoration construction activities possible			Bird Track Springs – Yes	site. Most of the removal is expected to occur from existing roads and no additional detrimental soil impacts are anticipated. The Bird Track Springs project would have similar short-term impacts to those described above for this project. Long-term impacts are expected to be minimal. Suggest a single construction season or adequate protection across seasons.
Wildlife Enhancement: GG Owl Platforms Aspen Enhancement		No	No	No	
Mining		No	No	No	
Private Land Activities: • Private Structures • Roads • Grazing		Yes	Yes	Structures – No Roads – No Grazing – Yes	Grazing – An existing corral on the private property portion of the active project area would be moved out of the project area, reducing livestock impacts to the soil.

As with the No Action Alternative, reasonably foreseeable actions include OHV use and livestock grazing. The Bird Track Springs project, while different in its specifics, has an intensive construction footprint on floodplain soils.

The Bird Track Springs project, while different in its specifics, has an intensive construction footprint on floodplain soils. The Bird Track Springs project is experiencing similar short-term direct and indirect impacts to those described above for the Longley Meadows project. Because the timing for initiating implementation of the Longley Meadows project would most likely be within a year following completion of the Bird Track project, the short term impacts to soils resources from Bird Track would most likely have been remediated and well into recovery with streambanks stabilized, vegetation establishing, and compacted soils rehabilitated and planted to native species. The changes in channel morphology and increased large wood within the Longley Meadows reach would capture most of the residual sediment which may occur; therefore, due to rehabilitation and project design, negative cumulative impacts to soils resources are expected to be immeasurable when combined with the Bird Track project. Beneficial impacts to soils resources (such as rehabilitation of streambank erosion areas, decompaction, increased stabilization from vegetation and streambank structures, etc.) within these stretches however; are anticipated to be significantly improved across all ownerships. Bird Track has recently experienced high water and erosion in the year1 phase of construction. It is recommended the Longley Meadows project be constructed in a single season to avoid potential flooding in an unfinished project with exposed soils. If phased construction is necessary, project managers must take adequate measures are taken to ensure proper protection of exposed soils across seasons.

Long-term impacts are expected to be minimal.

Displacement and erosion, the loss of topsoil, is a long-term and perhaps a permanent loss of soil productivity. However, best management practices and soil mitigation strategies outlined above would reduce the occurrence of displacement and erosion to be within the Region 6 standards. Compaction may last from 10 to 70 years (Gonsior 1983). Compaction can be adequately mitigated through subsoiling and decompacting skid trails and recontouring temporary roads to be within the Region 6 standards.

Subsoiling restores biological processes that are reduced by soil compaction (Dick et al. 1988). In general, tilling or scarifying a compacted soil improves productivity by reducing the resistance of soil to root penetration and providing improved soil drainage and aeration to enhance seedling establishment and tree growth (Bulmer 1998). Soil restoration is not the immediate result of ripping, planting, or any other activity. The goal of soil restoration is to create favorable conditions for impaired soils to begin the recovery process. Reductions in organic matter content reverse quickly as vegetation is established. Organic debris accumulates on the surface and roots grow and are decomposed in the soil. These organic materials break down and release nutrients and improve the quality of the soil by improving its structure and reducing compaction and other detrimental soil disturbances. Loss of organic-matter is a short-term change lasting about 10 years once vegetation returns to the soil.

Soil erosion would be controlled through the use of erosion control measures. In addition, bare soils would naturally recover to be re-vegetated with native seed. Any erosion that occurs would be short-lived, most likely occurring during the time between the soil disturbance and the implementation of erosion control measures.

Unauthorized user-built OHV trails and OHV use is spread across most of the landscape within the Spring Creek area, contributing to sediment production, soil disturbance, and soil compaction. Soils could be impacted in the short term, but the long-term benefits of the project in combination with the implementation of travel management (which would manage cross-country motor vehicle use) within the project area is expected to yield a net improvement in soil conditions.

With restoration of soils in the project area and the resulting enhancement of floodplain function, detrimental soil conditions are expected to improve over the long term as overbank flows deposit sediment in the floodplain and riparian vegetation and trees become established (Graham 1994; Harvey et al. 1987, 1994). A similar outcome is expected for the Bird Track Springs project. There could, however, be a temporary cumulative increase in erosion and sedimentation rates from the sites if a storm event of sufficient magnitude were to occur during construction.

3.6 Irreversible and Irretrievable Commitments for Soil Resources

The proposed action is not expected to create any impacts that would cause irreversible damage to soil productivity. Tree removal and floodplain construction would avoid landslide-prone areas, existing debris slides/debris torrents, and other potentially unstable lands on steep slopes. Careful planning, project design requirements, mitigation measures, and BMPs would be used to prevent irreversible losses of soil resources.

4 Additional Disclosures for Soil

4.1 Prime Farmlands, Rangeland, Forest Land

Actions taken under either alternative would have no impacts to farmland, rangeland, or forest land inside or outside the National Forest. There are no prime farmlands affected by the proposal.

5 Literature Cited

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